Dec. 12, 1939. P. C. ABOUCHAR 2,182,775

METHOD OF MAKING DIES

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Fig. 1.

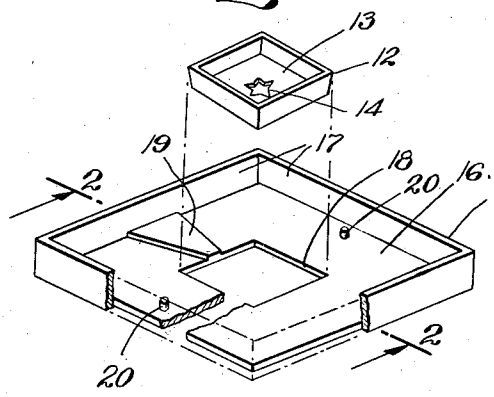

Fig. 2.

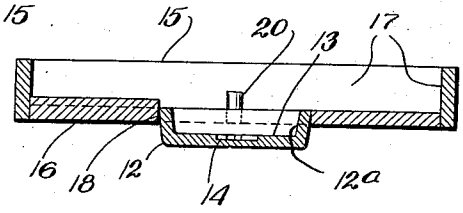

Fig. 3.

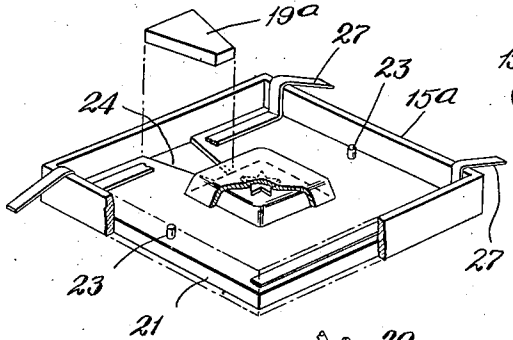

Fig. 4.

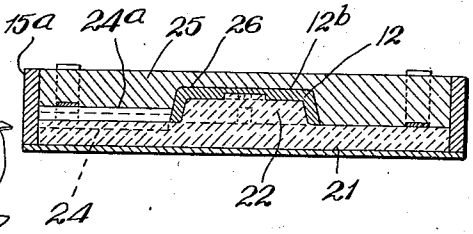

Fig. 5.

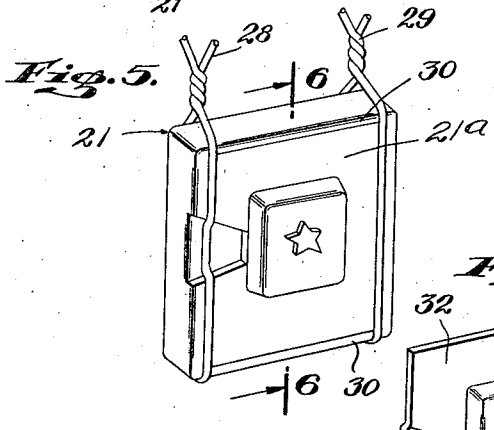

Fig. 6.

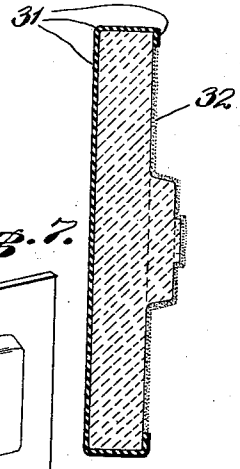

Fig. 7.

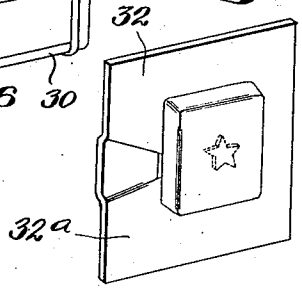

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Fig. 8.

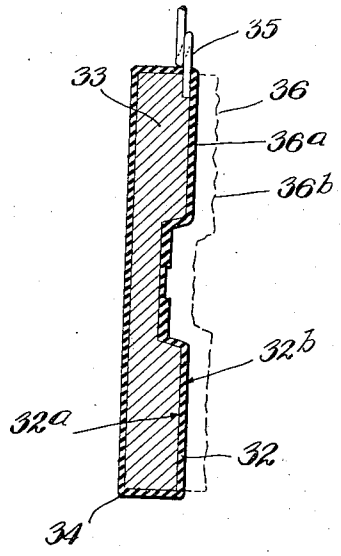


Fig. 9

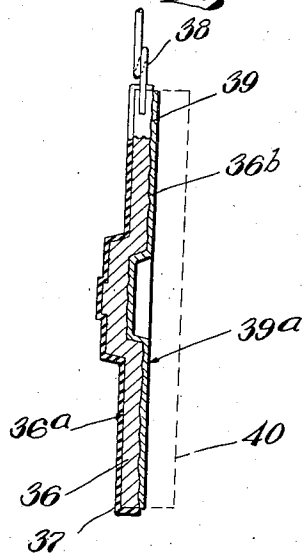


Fig. 10.

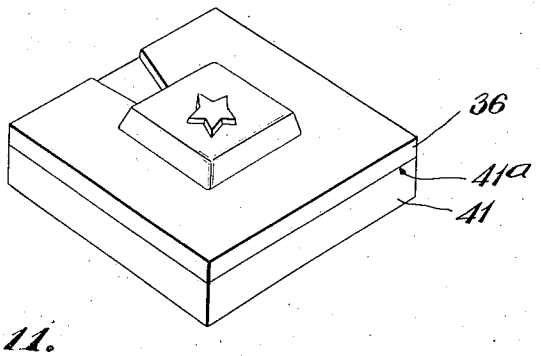
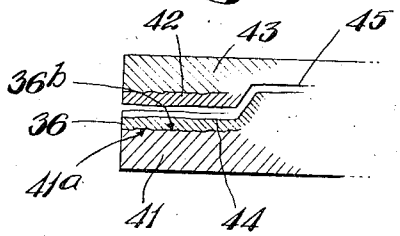


Fig. 11.



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UNITED STATES PATENT OFFICE

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METHOD OF MAKING DIES

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Application March 17, 1937, Serial No. 131,315
Renewed March 4, 1939

6 Claims. (Cl. 204—6)

This invention relates to the manufacture of dies for use in casting or molding various kinds and classes of materials; and the object of the invention is to provide a method of forming one or a number of dies from a pattern or model of a predetermined article to be produced or from a produced article in the operation of forming a die to accurately reproduce such article; a further object being to provide a method or process of the class described which consists in first making plaster casts of the pattern or article to be reproduced by the casting of the resulting dies or the separate parts thereof, then electrodepositing copper on one surface of each plaster cast to form a replica of opposed surfaces of the article to be formed, then utilizing the copper elements formed as a pattern or mold and electrodepositing iron on one surface thereof to form an iron die or die parts of the desired contour capable of reproducing the original pattern or sample; a further object being to provide means for reinforcing and backing the resultant iron dies to adapt them for predetermined uses in making die castings; and with these and other objects in view, the invention consists in the method or process of die making as more fully hereinafter described and claimed.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which:

Fig. 1 is a perspective and sectional view of a suitable frame or mold employed in making the original plaster casts with the pattern or sample to be arranged therein shown in an extended position and also showing parts of the construction broken away and in section.

Fig. 2 is a section on the line 2—2 of Fig. 1, with the parts assembled.

Fig. 3 is a view similar to Fig. 1, illustrating the next successive steps in the formation of the plaster casts.

Fig. 4 is a sectional view similar to Fig. 1 of the structure shown in Fig. 3 and illustrating the resulting plaster casts.

Fig. 5 is a perspective view illustrating the next step in the process which I employ.

Fig. 6 is a section on the line 6—6 of Fig. 5.

Fig. 7 is a perspective view of a part of the structure shown in Fig. 6, detached.

Fig. 8 is a sectional view through the mold, showing the next step in the process of forming the same, indicating the finished iron or steel deposited in dotted lines.

Fig. 9 is a view similar to Fig. 8, illustrating the first methods in the steps of forming a backing for the die.

Fig. 10 shows the completed die or one part thereof made according to the invention; and

Fig. 11 is a cross sectional view through part of a complete die or the separate parts thereof, made according to my invention.

In carrying the invention into effect, I may construct in any suitable manner an article to be produced or what may be termed a pattern of such article, or in some cases where it is desirable to reproduce an article previously made in any desired manner, I may use such article as the pattern piece.

In the accompanying drawings, I have indicated at 12 a pattern piece or article in the form of a tray or dish, the bottom wall 13 of which is provided with a recess or depression 14 in the form of a star to give ornamentation or design to the tray. The first step in the process consists in providing a plaster mold 15 in the form of a bottom plate 16 and upwardly extending side walls 17 which may be of any desired shape or contour and of dimensions suitable for controlling or substantially controlling the peripheral contour of the finished die to be formed. The plate 16 is provided with an aperture 18 which fits snugly around the peripheral walls of the pattern 12 as clearly seen in Fig. 2 of the drawings. The plate is also preferably provided with a raised wedge member 19 for forming a gate in the finished die when such gates are desirable. However, in some uses of the invention, the gate is not essential and this is especially true in making castings of Bakelite or similar thermo-setting plastic materials, whereas in the die casting of metals, thermoplastics and other materials, the gate is desirable. The size and contour of the gate will depend entirely upon the construction of the die, and in the present drawings the illustration throughout is purely diagrammatic.

If desired, alining pins 20 may also protrude from the upper surface of the plate 16 to provide proper alinement between the plaster casts to be made. After the parts have been assembled as seen in Fig. 2 of the drawings, a body of molding material or plaster of Paris is placed in the frame 15 and a perfect or substantially perfect impression will be taken of the inner surface 12a of the pattern 12. After this plaster cast is made, the same being designated at 21 in Figs. 3, 4 of the drawings, this cast is placed in another frame

15*a*, substantially similar to the frame 15, and the pattern 12 is arranged upon the molded portion 22 of said cast and alinement pins 23 are placed in the apertures of the cast 21 and project upwardly into the chamber of the frame 15*a*. A gate forming piece 19*a* is arranged in the gate recess 24 formed in the cast body 21 by the member 19 and projects above the surface of the plaster cast 21 so as to form a similar recess 24*a* in the second plaster cast 25 which has a mold recess or impression 26 conforming with the outer walls 12*b* of the pattern piece 12.

Prior to forming the plaster cast 25, two thin strips of ribbon or fabric 27 are arranged upon the upper surface of the body 21 adjacent two edges thereof, and the upper surface of said body will be coated with a suitable material to prevent adhesion of the plaster cast 25 therewith. When the body 25 becomes set and hard, the same is removed by the aid of the strips 27. After removing the pattern 12 and the part 19*a* as well as the pins 23, two bodies 21 and 25 will remain and these bodies are treated through a series of steps in the formation of the resulting molds or dies.

In order to illustrate, the invention, the further steps of the process will be applied to the plaster body 21 only, it being understood that similar steps are employed in conjunction with the body 25 in forming the two resulting die or mold parts.

The next step in the process consists in coating the entire body 21 with shellac, lacquer or similar material which is allowed to dry, after which a thin coating of lacquer is then applied to the surface 21*a* of the body 21. Before this coating is dry, fine copper powder or graphite is brushed thereon to form an even, continuous metallic or graphite surface. I then attach two copper wires 28, 29 to the body 21 and over and in contact with the treated surface 21*a*, after which the entire body 21, except for the surface 21*a* between the wires 28 and 29 and inwardly of the upper and lower edges 30 thereof are coated with wax or other suitable non-conducting material, as is indicated at 31 in Fig. 6 of the drawings. The body 21 treated and prepared as above described is now placed in a copper electrodepositing or electroplating bath for a sufficient length of time to produce the desired deposit of copper upon the surface 21*a*, which will be in the form of a relatively thin shell as seen at 32 in Fig. 7 of the drawings, which is also indicated in cross section in Fig. 6 of the drawings. This shell 32 is then removed from the body 21. It will be understood in this connection that any other types of metal deposits may be formed in the manner of the copper deposit which would be suitable for the purposes herein named, or, if desired, a metallic cast may be made on the plaster or other molded body.

The next step of the process consists in arranging a suitable backing upon the surface 32*a* of the copper shell 32, and this backing may be in the form of a body of plaster of Paris 33 or a body of wax, lead or the like suitably molded thereon, or, if desired, may consist of a body of low melting lead alloy, soldered or otherwise secured to the surface 32*a* of the shell 32. In some cases, the backing may not be necessary, but this would depend largely upon the thickness of the shell or the design of the mold cavity therein, or the backing may be applied before the shell 32 is removed from the body 21. In any event, the rear surface of the shell 32*a* or the backing 33 is then coated with lacquer or other suitable non-conductive material 34. Two wires 35 are arranged to contact the inner surface of the shell 32 and the surface 32*b* of the shell is then polished or brushed to a perfect smoothness by any suitable means after which the next step in the operation is performed.

The next step of the process consists in placing the shell 32 treated and prepared as above stated in an iron electrodepositing or an electroplating bath a sufficient length of time to form on the surface 32*b* of the shell 32 a deposit of iron or steel as indicated in dotted lines at 36 in Fig. 8 of the drawings. The surface 36*a* of the deposit adjacent the surface 32*b* of the shell 32 will be a perfect or substantially perfect reproduction of the surface 32*b*, whereas, the surface 36*b* will be rough or irregular.

In the production of molds or dies of various kinds and classes, the degree of time for the iron deposit will be varied to suit the conditions to which the die or mold is to be subjected. In other words, the thickness of the deposit will be varied to give the required strength and rigidity to the resulting die or mold. After the desired deposit has been formed as at 36, the same is removed from the bath and stripped from the shell 32 and this deposit 36 forms, in so far as the surface 36*a* is concerned, one half of the resulting die or mold to be used in making moldings or castings as heretofore stated. The die 36 may be heat treated, annealed, tempered or otherwise prepared for giving it the required strength in the respective uses to which the same is to be applied. The die or mold 36 may be trimmed to a finished contour and the surface 36*a* thereof treated in any desired manner to provide the proper finish or polish thereon. At the same time, the surface 36*b* may be finished in such manner as to suit it for the particular use to which the die is subjected. In some cases, a suitable backing may be cast or molded thereon or a finishing plate may be attached thereto. However, in some uses and especially where the die or mold parts are subjected to heavy pressures, it would be desirable to provide a very accurate backing for the rough or irregular surface 36*b*. In this case, I proceed as follows.

The surface 36*a* of the die part 36 is coated with a suitable non-conducting material as indicated at 37. Electric wires 38 are attached to the die and a copper shell 39 is formed on the surface 36*b* of the die by copper electrodepositing the same thereon in the manner of forming the shell 32. After the copper shell 39 has been formed and before removing the same from the die 36, a low melting point alloy, preferably of lead, is soldered onto the outer surface 39*a* of the shell 39 to form a suitable backing body 40 as indicated in dotted lines in Fig. 9 of the drawings, after which the shell 39 including the backing 40 is removed from the die 36 and a casting of iron, steel or other material is made therefrom.

In Figs. 10 and 11 of the drawings I have shown such resulting casting at 41. The surface 41*a* is of a contour similar to the contour of the surface 36*b* of the die 36, thus providing an accurate or substantially accurate backing for said die. In some instances, the copper shells 39 with a suitable backing body as at 40, which may be in the form of an alloy or a cast of some other material, may be used as a finish or backing in the use of the die 36. It is only where the die is subjected to heavy stresses or strains or excessive pressures, that backing similar to the backing 41 is required. It will be understood that the dies may be actuated hydraulically or pneumatically, in which latter event, the contour

of the outer surfaces thereof is of no real consequence.

In Fig. 11 of the drawings, I have shown at 42 the other die part which would be made from the plaster cast 25 in accordance with the steps heretofore mentioned in the treatment of the plaster cast 21 and the successive parts constructed therefrom. At 43 I have shown the backing applied to the die 42 which is similar to the backing 41. At 44 is shown the gate giving admission to the impression or mold chamber 45 between adjacent surfaces of the mold or die parts 36 and 42, which impression or mold chamber conforms with and will produce in the resulting casting or molded part formed therefrom an article which would be an exact or substantially exact reproduction of the pattern piece 12.

Where it is desirable to make a number of similar dies or molds, any desired number of the same may be produced from the shell 32 including its backing 33 as shown in Fig. 8 of the drawings. If desired, these dies or molds may be assembled in a suitable frame and a single unitary backing similar to the backings 41, 43 or the backing 40 formed therefor. In some cases, the individual die parts may be fitted or set in predetermined receptacles in a multiple die holding plate or body, the die or the backing therefor being shaped to fit accurately in such plate or support.

With a process of the class described, accurate or substantially accurate reproductions of a predetermined article or a pattern of an article may be produced from a die formed in the manner described or from a multiplicity of dies produced in this manner, in which event, all of the castings will be identical, notwithstanding the fact that they are made from a multiplicity of independent die units in what is commonly termed a multiple impression die. Replacement or renewal of dies may be made from time to time at a very nominal cost, and in fact, the cost of producing the original dies is economical as compared with present methods of preparing dies or molds of the kind under consideration. Instead of depending upon the accuracy of a workman, an accurate reproduction of the article or pattern piece 12 is assured by my process.

My invention will find its special usefulness in the preparation of the dies or molds in the art of making thermo-setting castings of Bakelite and similar thermo-setting materials as well as in the art of die casting metal alloys and thermo-plastic materials, it being also understood that the dies may be used for forming or shaping certain kinds and classes of materials in the manner of stamping and sheet metal forming dies now in general use, and especially where the tensile strength of the die is not an essential factor as would be the case in working heavy sheet metals or in punching or stamping metals.

My invention not only consists in the process of producing die or mold parts as herein specifically described, but also in a novel construction of die or mold parts wherein adjacent surfaces of said die or mold parts including the walls of the impression or mold chamber formed therebetween consist of electrodeposited iron, thus producing a fine grade of die or mold parts, especially due to the fact that only the better types of metals are suitable in this type of construction. Where the dies or mold parts are utilized in the formation of die castings, suitable means of circulating water or other cooling agents through the die parts will be provided. If desired, these passages may be formed between the iron die facings and their backings or formed only in the backings.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A die or mold of the class described comprising at least two parts with an impression or mold chamber formed between adjacent surfaces of said parts, each of the opposed walls of the mold chamber being female exact reproductions for the surfaces of the article to be produced, and the walls of the impression or mold chamber of said die parts consisting of electro-deposited iron having finished hardened surfaces.

2. A die or mold of the class described comprising at least two parts with an impression or mold chamber formed between adjacent surfaces of said parts, each of the opposed walls of the mold chamber being female exact reproductions for the surfaces of the article to be produced, the adjacent walls of the die parts including the impression or mold chamber thereof consisting of electrodeposited iron having finished hardened compression surfaces, said walls including a backing of reinforcing and strengthening material, and said backing being of predetermined contour.

3. The process of constructing dies of the class described which consists in taking a predetermined object to be reproduced from the dies, first making plaster casts of the separate side surfaces of said pattern, then forming a die from each plaster cast by first producing electrodeposited copper shells on the impressions of said plaster casts, removing said shells from the plaster casts, then electrodepositing iron on the impression surfaces of said copper shells, and then stripping off the copper shells to form the resulting metal dies, each having an accurate female impression of one side surface of the original object employed.

4. The process of constructing dies of the class described which consists in taking a predetermined object to be reproduced from the dies, first making plaster casts of the separate side surfaces of said pattern, then forming a die from each plaster cast by first producing electrodeposited copper shells on the impressions of said plaster casts, removing said shells from the plaster casts, then electrodepositing iron on the impression surfaces of said copper shells, then stripping off the copper shells to form the resulting metal dies, each having an accurate female impression of one side surface of the original object employed, and applying a suitable backing to the copper shells prior to forming the electrodeposited iron thereon.

5. The process of constructing dies of the class decribed which consists in taking a predetermined object to be reproduced from the dies, first making plaster casts of the separate side surfaces of said pattern, then forming a die from each plaster cast by first producing electrodeposited copper shells on the impressions of said plaster casts, removing said shells from the plaster casts, then electrodepositing iron on the impression surfaces of said copper shells, then stripping off the copper shells to form the resulting metal dies, each having an accurate female impression of one side surface of the original object employed, and then applying suitable reinforcing backings to the dies to finish and give predetermined contour thereto.

6. The process of constructing dies of the class described which consists in taking a predetermined object to be reproduced from the dies, first making plaster casts of the separate side surfaces of said pattern, then forming a die from each plaster cast by first producing electrodeposited copper shells on the impressions of said plaster casts, removing said shells from the plaster casts, then electrodepositing iron on the impression surfaces of said copper shells, then stripping off the copper shells to form the resulting metal dies, each having an accurate female impression of one side surface of the original object employed, and suitably treating the impression surfaces of the dies to finish and harden such surfaces.

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